

A satellite map of Lake Michigan and its surrounding land areas, including parts of the United States and Canada. The lake is a dark blue-green color, and the surrounding land is a mix of brown, tan, and green, indicating different terrain types and vegetation. The text is overlaid on the map.

Integration and Coordination of Multiple Tributary and Near- Shore Monitoring Efforts and the Use of Technology to Enhance these Efforts

Charles A. Peters

State of Lake Michigan 2011

September 27, 2011

Tributary and Near-Shore Monitoring Efforts

- Lake Michigan Monitoring Coordination Council Near Shore Monitoring work group (LMMCC – NeMo)
- USGS GLRI Rivermouth and Tributary projects
- National Monitoring Network pilot project

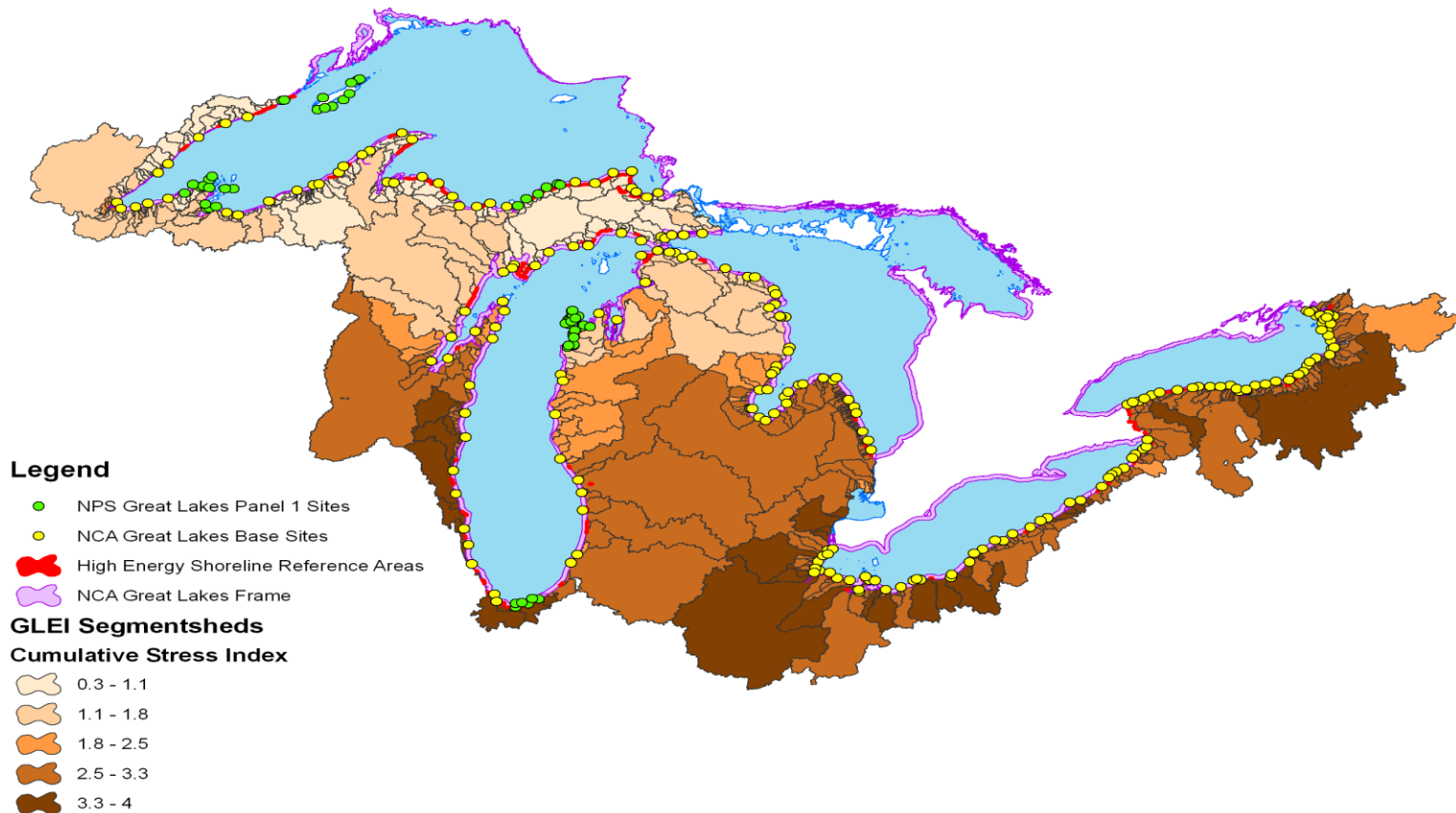
LMMCC NeMo workgroup

- Members: Federal, State, Municipalities, Universities, and Non-profits
- Goals:
 - Understand and inventory nearshore monitoring activities (developing a web mapper);
 - coordinate implementation of a nearshore network;
 - identify monitoring gaps;
 - coordinate database approach;
 - develop a nearshore conceptual model;
 - integrate data reporting.

Examples of Lake Michigan Nearshore Activities

- USEPA National Coastal Assessment
- University and State near shore Buoys
- University and Federal near shore biology research
- USEPA Triaxus tows of nearshore zone
- USGS GLRI tributary, river mouth, beach, and near shore monitoring (9 projects)
- State and local tributary and river mouth (embayments) monitoring
- UWM sensors on Ferry crossings

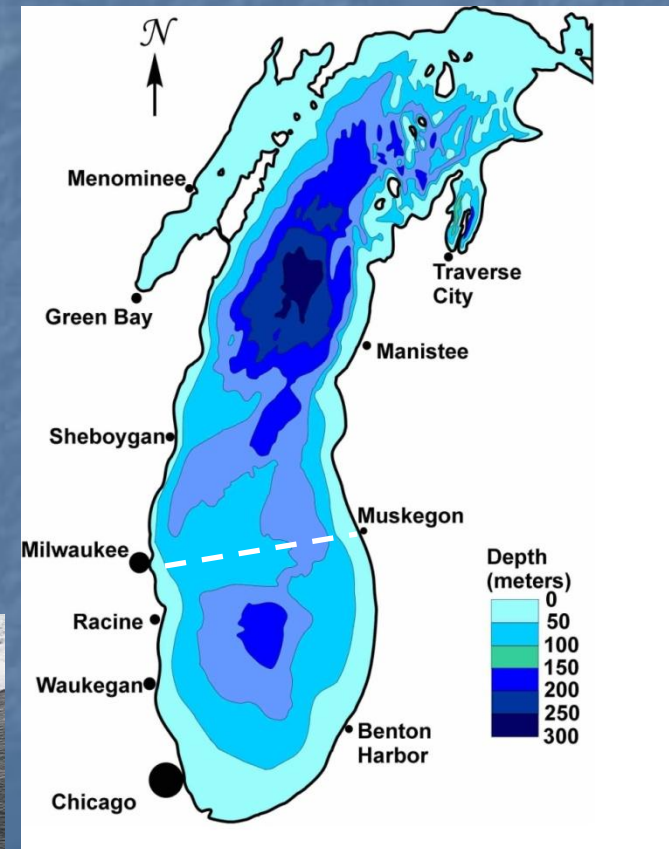
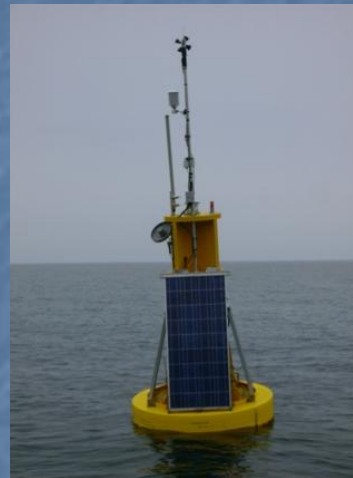
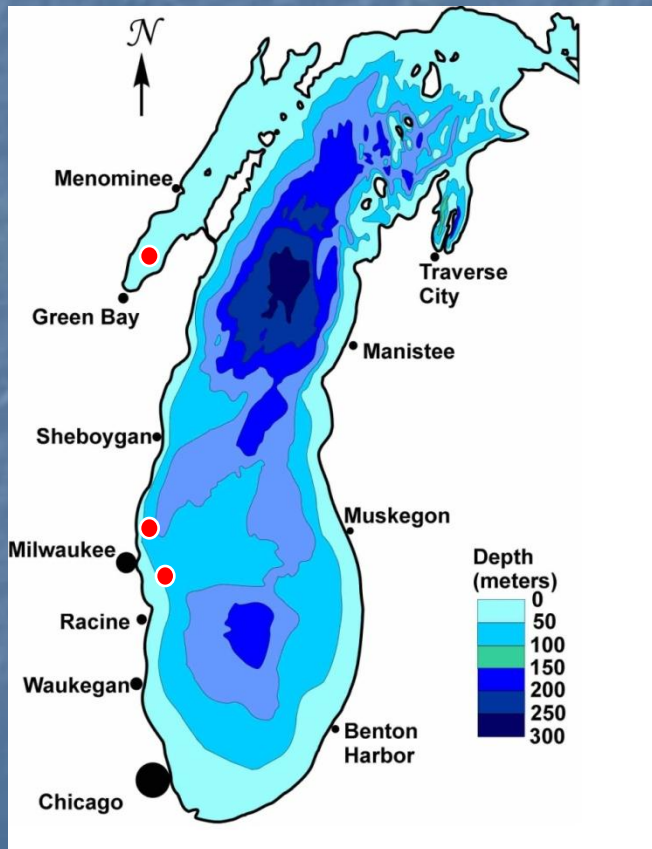
USEPA National Coastal Condition Assessment in the Great Lakes



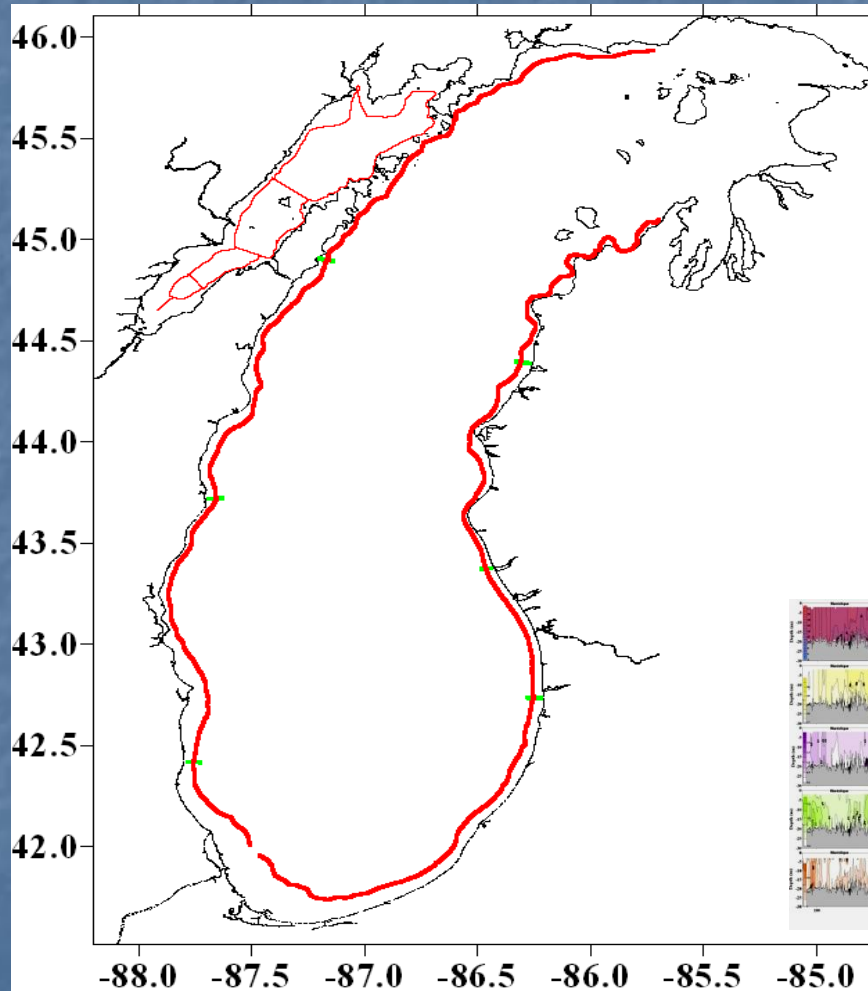
Grand Valley State Muskegon River Monitoring



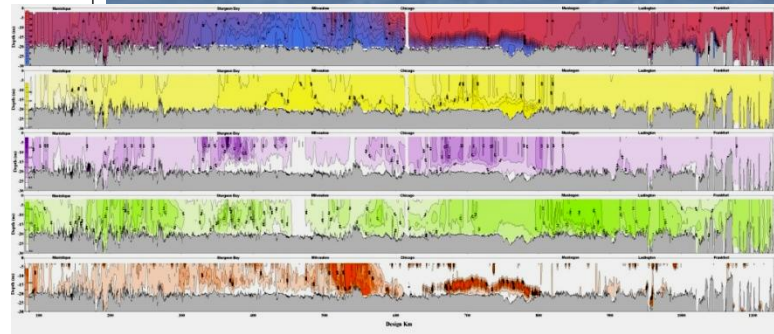
UW-Milwaukee Buoy and Ferry Sensors



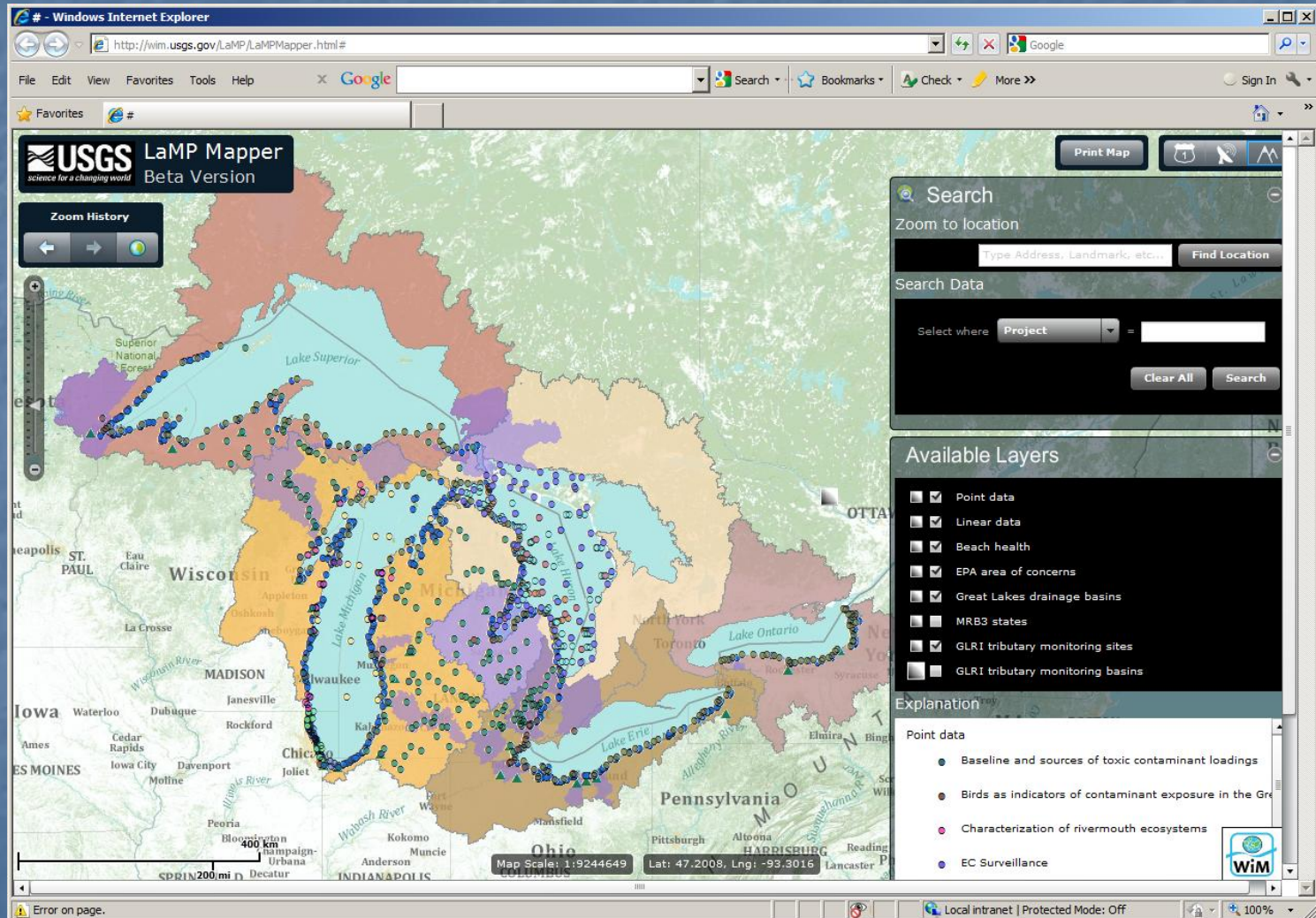
USEPA Lake Michigan 20 m contour Triaxus tow



Sensor suit: CTD (conductivity, temperature, depth), Fluorometer, Transmissometer, Laser Optical Plankton counter, (and limited NO_3 sensor)



Great Lakes Activities Web Mapping Application



Activities Data Entry System

LaMPTemplateExampleV3 (version 1).xlsx [Autosaved] - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View

Clipboard Font Alignment Number Styles Cells Editing

B2

1 This is a primer to explain how to enter data for your project(s). Please follow these instructions to ensure data a

2

3 This color means the field is required

4 This color means that the row is an example record

5

6 ****This spreadsheet uses several reference lists. Please choose only the values listed in the reference lists for the specified columns. New valu

7

8 1. Start on the Project Summary tab. Enter all required information and as much other information as possible. Please check the data type inform

9

| Column | Data Type | Description | Data Entry Rules |
|------------------------|-------------------|---|---|
| Organization | Varchar2(50) | The organizations responsible for the project. | Each organization should have a unique code. Please see the reference list and send us any new values |
| Division | Varchar2(10) | This is an organization division code | Please see organization reference list |
| Project Start Date | Date 'mm/dd/yyyy' | The approximate date the project started | If using the fill down feature, please enter the date |
| Project End Date | Date 'mm/dd/yyyy' | The approximate date the project ended | If the project is ongoing, please enter the date |
| Project Name | Varchar2(250) | Some identifying name of the project. | Each new project must be unique |
| Project Objective | Varchar2(250) | A text description of the purpose of the project. | |
| Data Management System | Varchar2(20) | This describes where the project data resides. Examples include: NWIS, Storet, Access, Excel spreadsheet | This is a comma separated list |
| Metadata Inquiry | Varchar2(50) | This gives the user information about where they can find more metadata about the project, when available | This should be in a comma separated list |
| Web Site | Varchar2(50) | A list of any websites describing the project. | This should be in a comma separated list |
| | | | If more than one contact is listed, please use the following format: Name, Title, Organization, Address, City, State, Zip, Country, Phone, Fax, Email |

READ ME Project Summary Project Location Project Publication Project Keywo

Ready 100%

USGS GLRI Activities Relative to the National Monitoring Network Design Resource Compartments

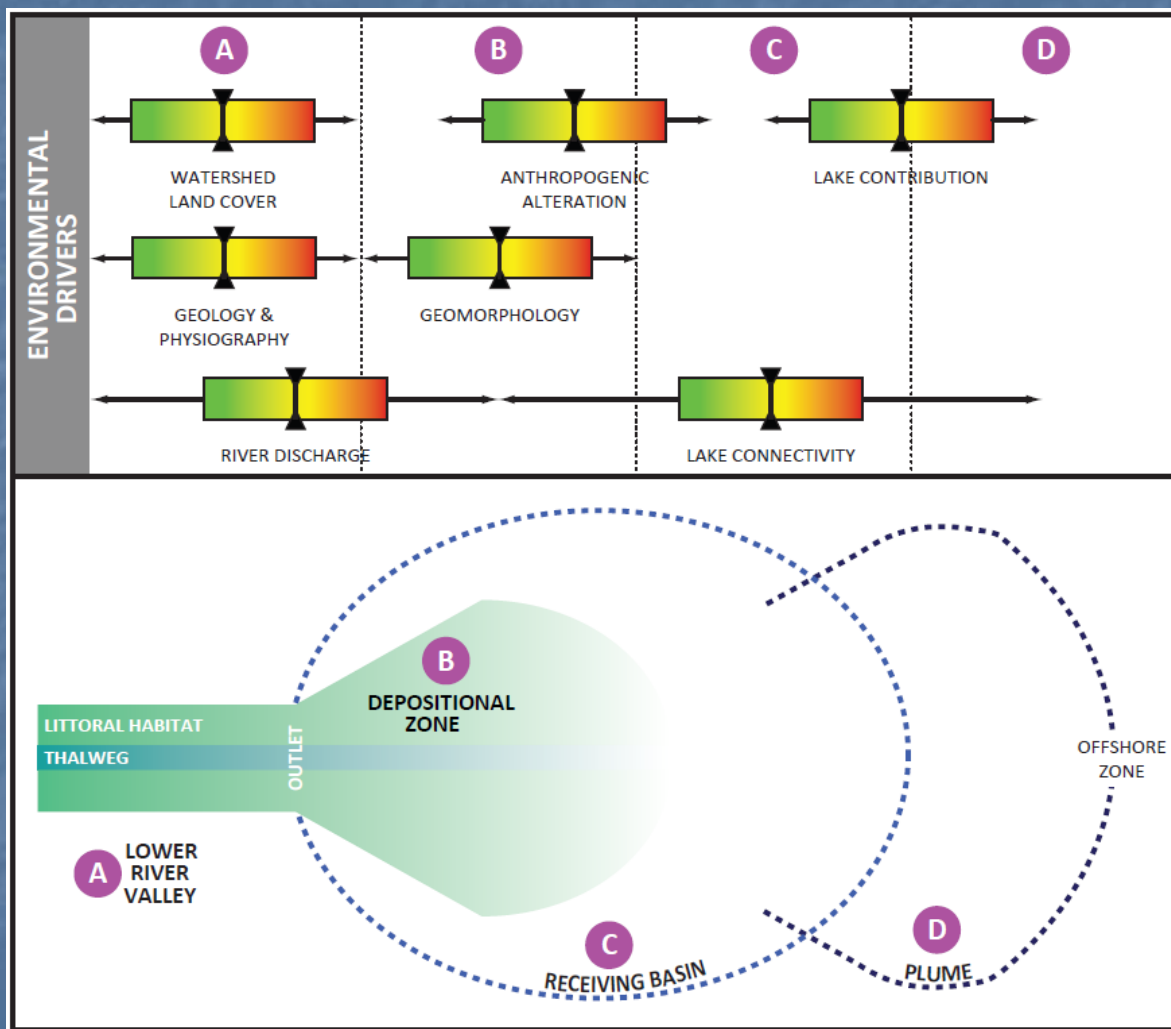
- Embayments
- GL Shallow Nearshore
- GL Medium Nearshore
- GL Offshore
- Rivers
- Ground Water
- Atmospheric Deposition
- Beaches
- Wetlands

Rivermouth Project Objectives

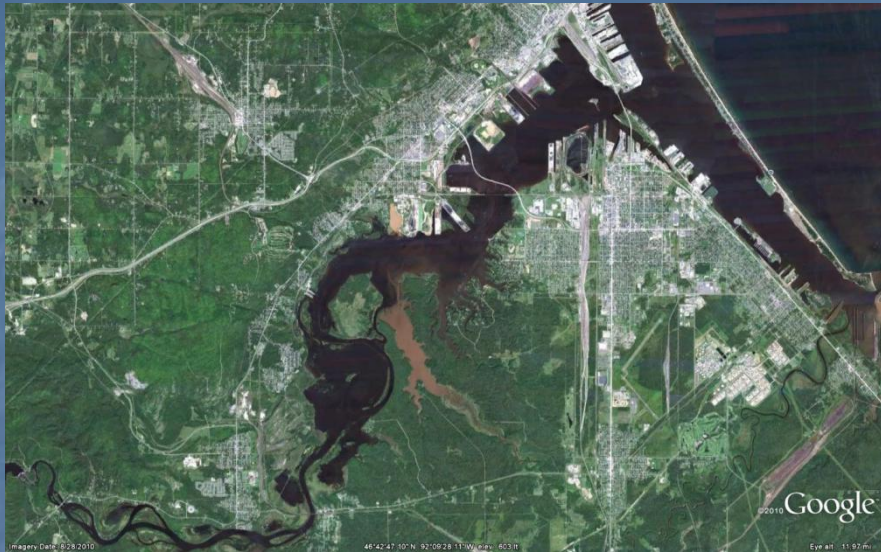
- Conceptual Model
- Classification
- Characterization of Ecosystem Structure and Function
- Collaboratory



Rivermouth Conceptual Model



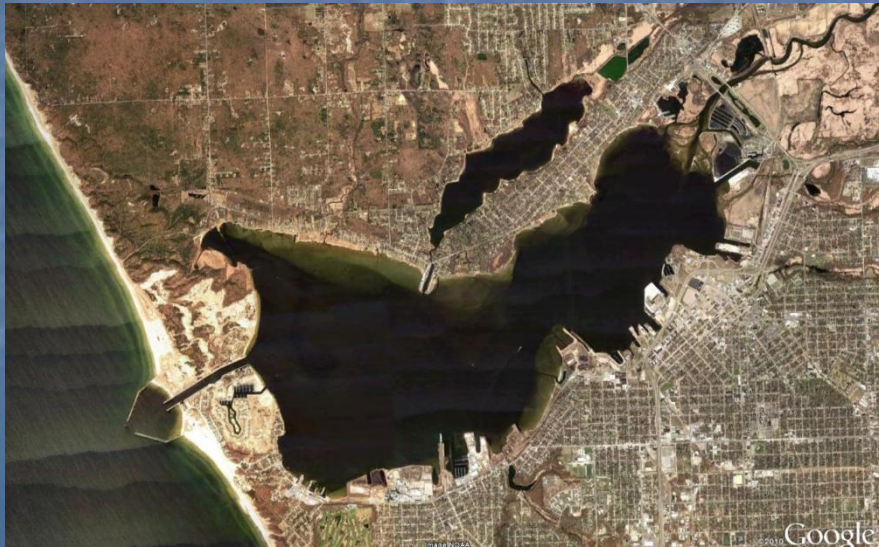
Rivermouth Classification



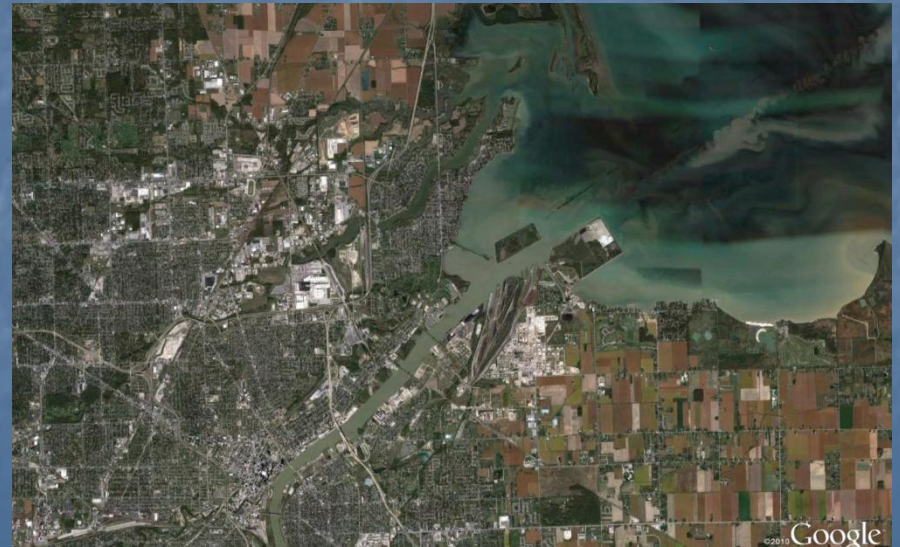
St. Louis River



Peshtigo River

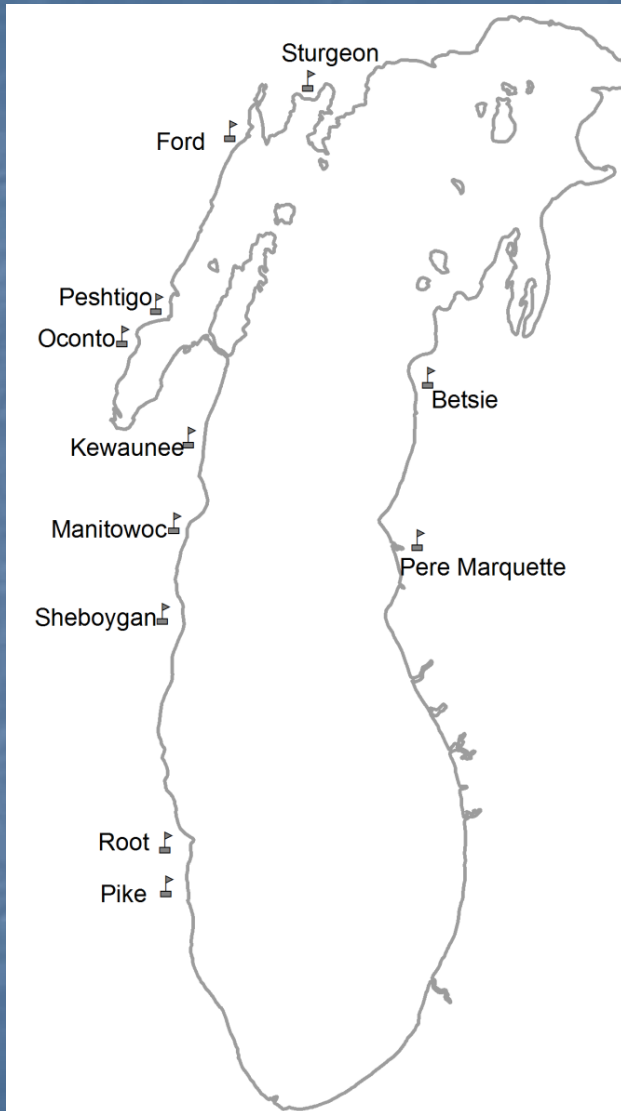


Muskegon River



Maumee River

Characterization of Structure and Function



Monitoring Design - Rivers

- 59 NMN river sites - toxic contaminant baseline
- 30 NMN river sites - automated monthly plus high flow sample collection and continuous sensor measurements to forecast/nowcast contaminant loads
- 17 NMN river sites - chemicals of emerging concern baseline
- 15 AOC sites – Toxics in Sediments
- 8 NMN river sites – pathogens and virus baseline



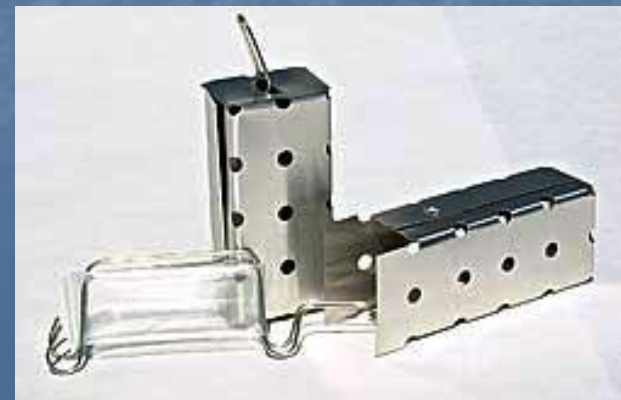
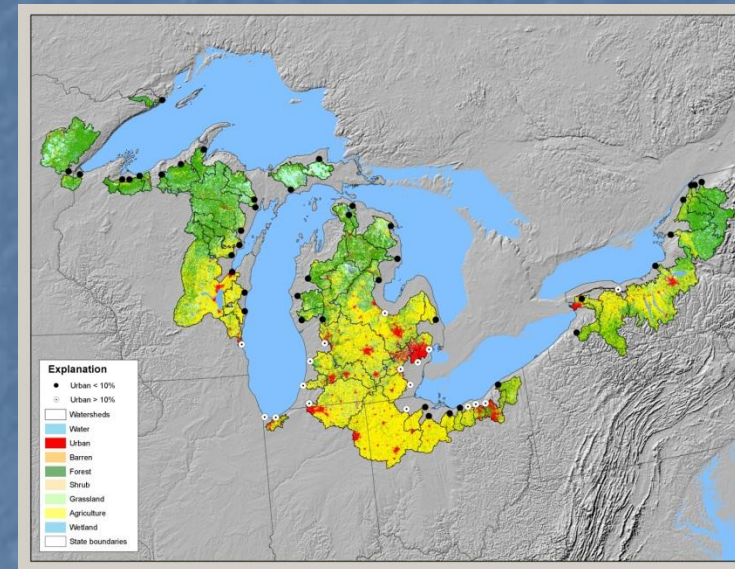
Tributary Monitoring Project Objectives

- Provide baseline information on contaminant loads at major Great Lakes tributaries,
- Provide quantifiable measures of restoration progress on major Great Lakes tributaries,
- Model potential load changes throughout the Great Lakes,

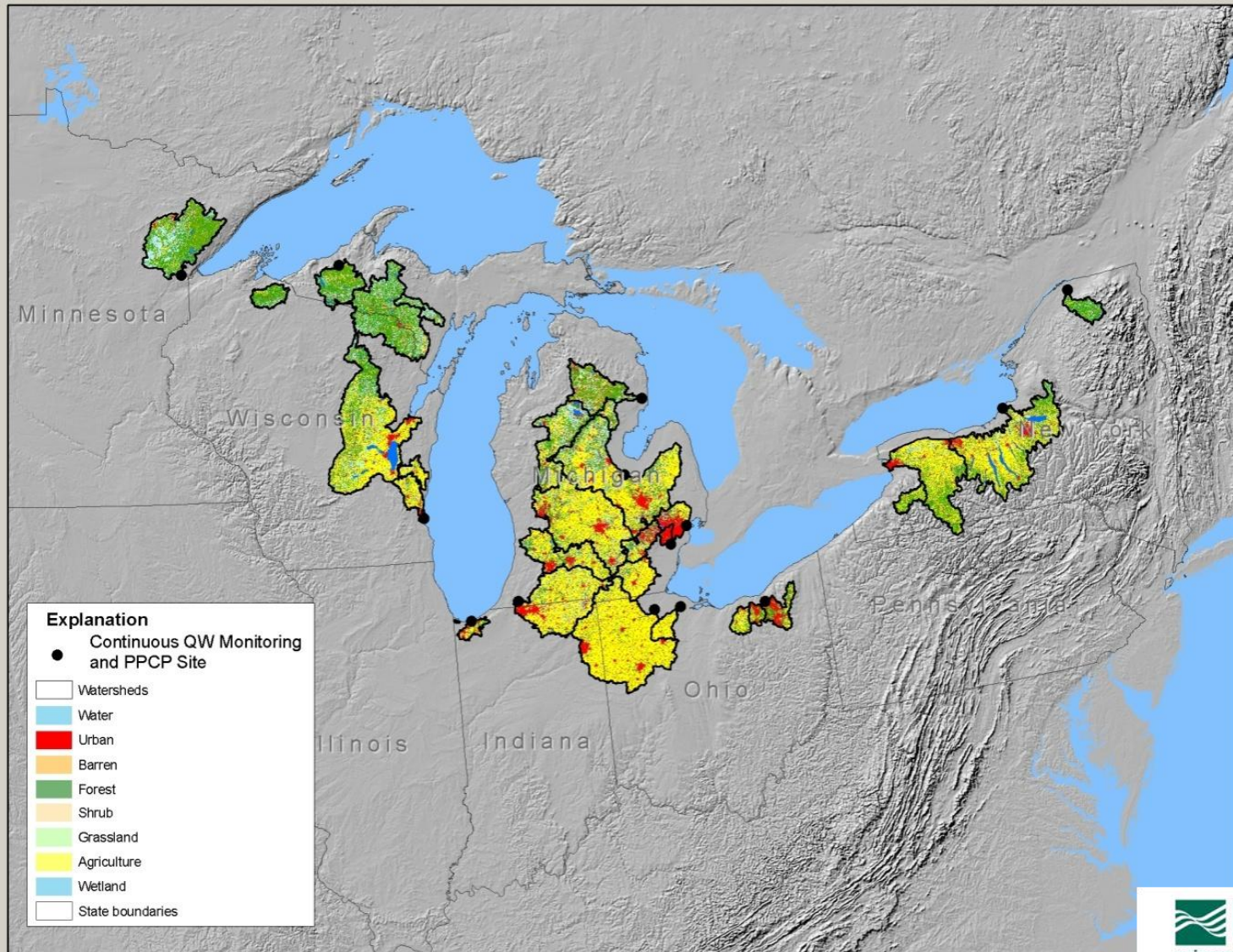
Determine Baseline of Toxic Contaminants

59 NMN sites sampled in fall of 2010

- **POCIS** (Polar Organic Chemical Integrative Sampler) monitor **hydrophilic contaminants** which could be potentially **endocrine disrupting or acutely toxic**
- **SPMD** (Semi-permeable membrane devices) designed to **mimic biological membranes, such as the gills of fish.**
- Water Samples for mercury and organic contaminants collected at time of installation. A 2nd sample collected in 2011.



30 NMN River sites instrumented for automated and continuous monitoring



Automated Sampling

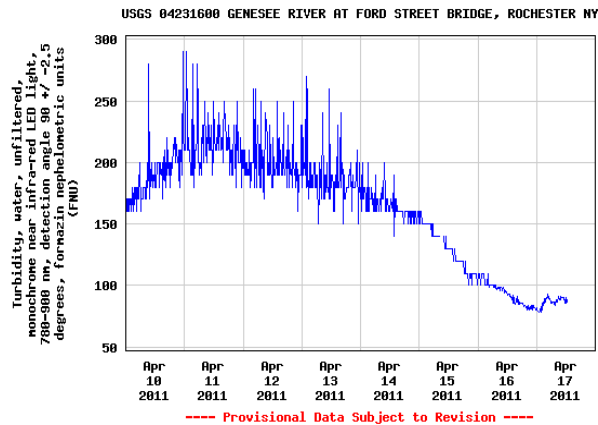
- Analytes include:
 - suspended sediment, nutrients, chloride, and bacteria.
 - one sample per storm event will be analyzed for major ions.
 - Continuously sensed data: High Turbidity, Low Turbidity, Temperature, Conductivity, Dissolved Oxygen, pH
- Monthly base flow samples (12) plus eight storms will be sampled with 6 samples submitted per storm (60 environmental samples per site)
- Samples will be used to develop statistical relations between continuously measured parameters and lab analyzed parameters.



Real-time sensor monitoring information available at: <http://waterwatch.usgs.gov/wqwatch/>

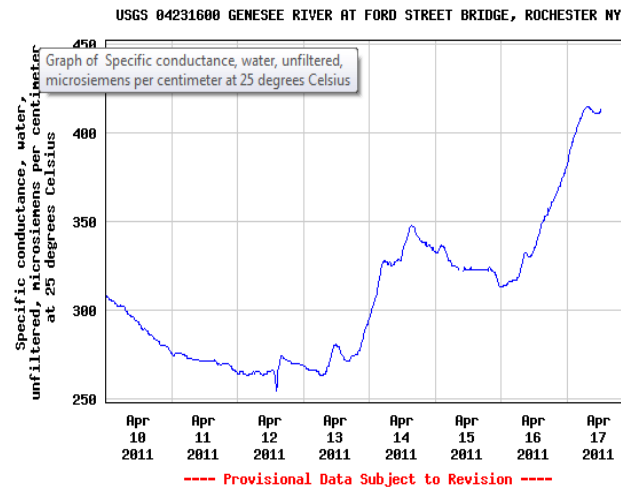
Turbidity, water, unfiltered, monochrome near infra-red LED light, 780-900 nm, detection angle 90 +/- 2.5 degrees, formazin nephelometric units (FNU)

Most recent instantaneous value: 87 04-17-2011 12:30 EST



Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius

Most recent instantaneous value: 413 04-17-2011 12:30 EST



Real-time Water Quality Monitors

Directly measured

Computed or estimated

Gage Height/Stage



Streamflow (discharge)

Specific Conductance



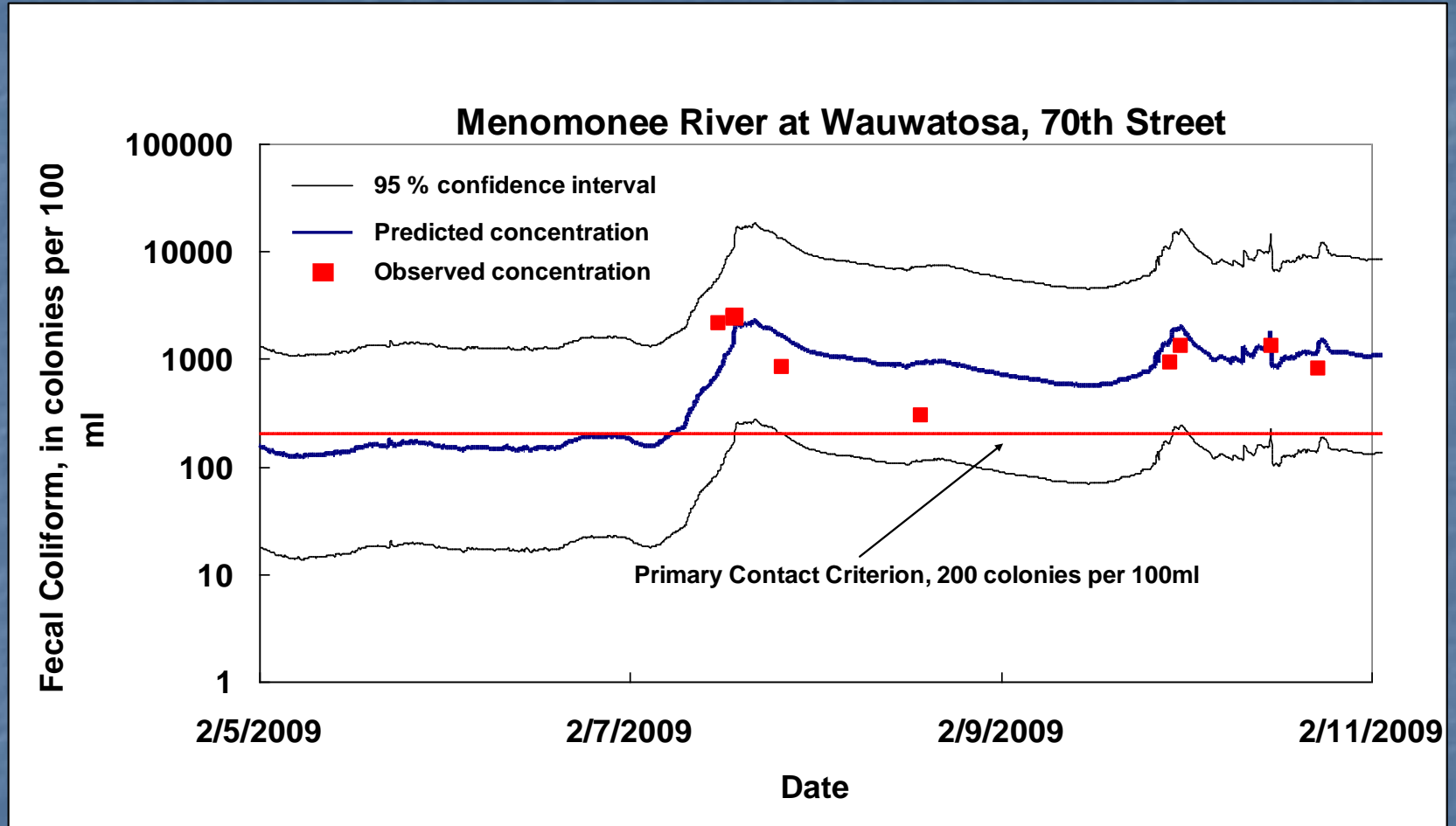
Chloride, alkalinity, fluoride, dissolved solids,
sodium, sulfate, nitrate, atrazine

Turbidity

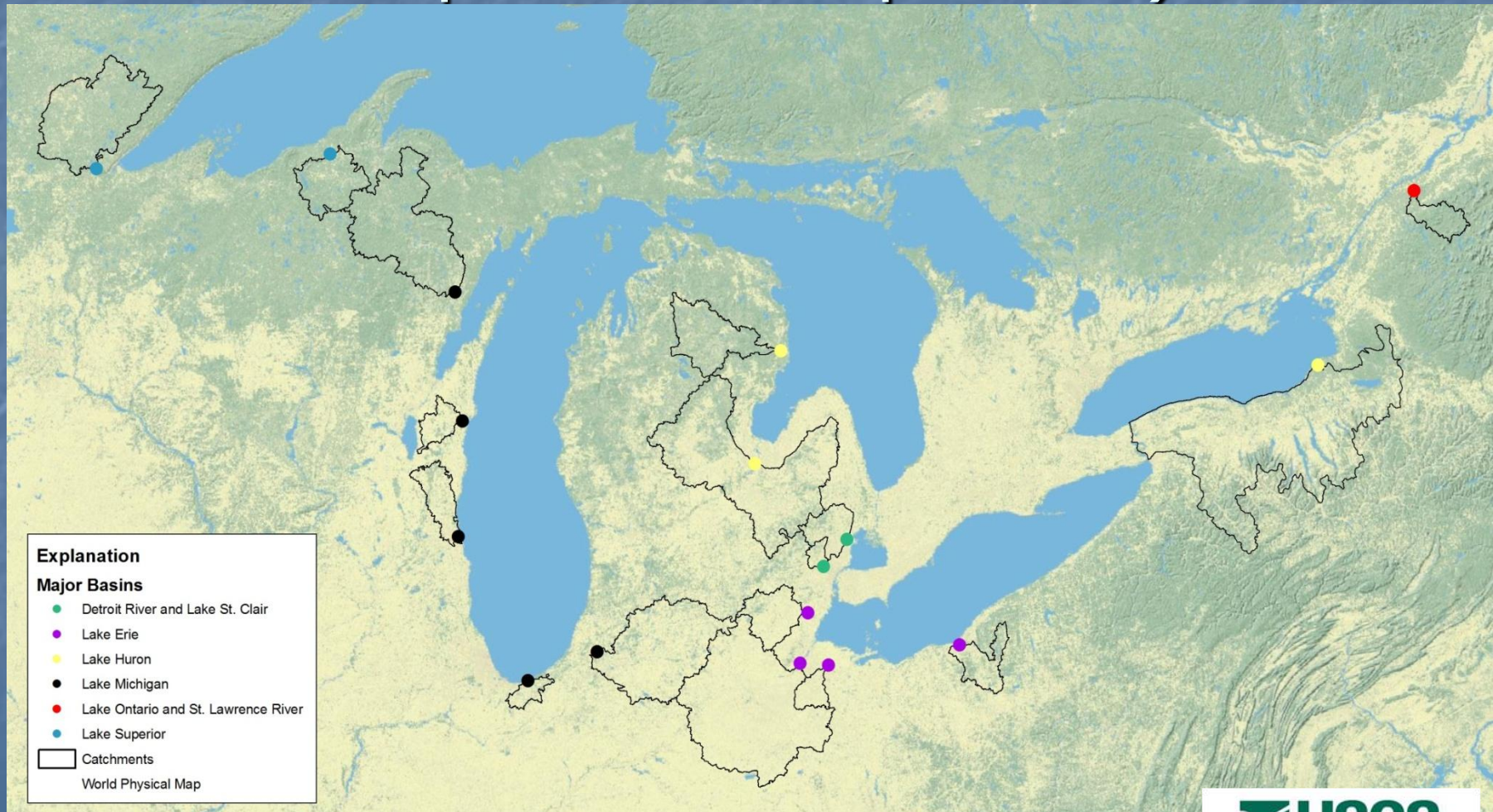


Total suspended solids, suspended sediment,
fecal coliform, E. coli, total nitrogen, total
phosphorus

Example of Real Time Surrogate



17 NMN River sites monitored for chemicals of emerging concern (PPCP - pharmaceuticals and personal care products)



Chemicals of Emerging Concern

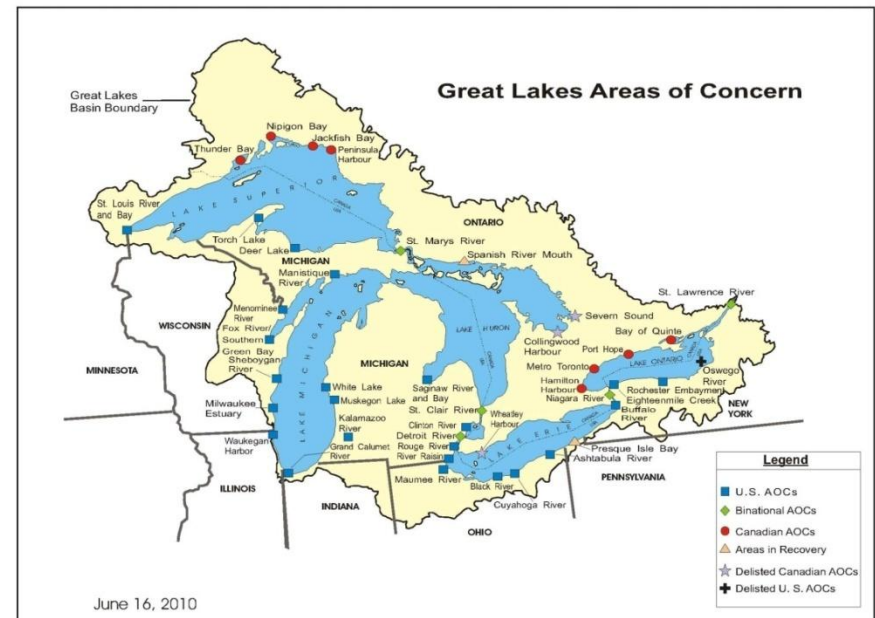
- At 17 sites representing agricultural, urban and reference conditions. Ten of the which are located at AOCs.
 - Collect monthly and 6 storms samples (18 samples annually) for Pharmaceuticals and Personal Care Products

Determine Baseline of Toxic Contaminants in Sediments

■ At 15 AOC sites in the Great Lakes Sediment traps were installed

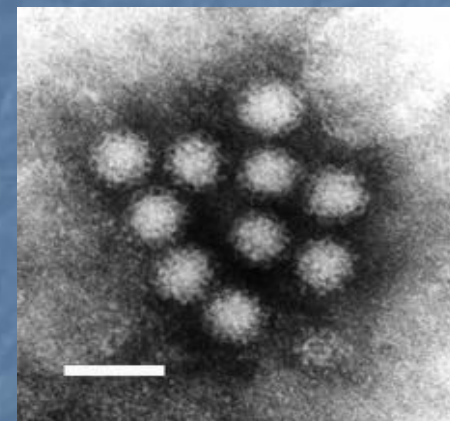
Analyzed for over 150 constituents:

- PAH's and Total PCB's
- Alkylated PAH's,
- Pharmaceuticals



Monitoring Tributaries for Pathogens and Viruses

- At 8 of the chemicals of emerging concern sites (6 AOCs) collect samples every other month (base flow) and for 12 storms using an auto sampler:
 - Monitor for 8 human viruses, 10 bovine viruses, 3 bacterial pathogens, and cryptosporidium



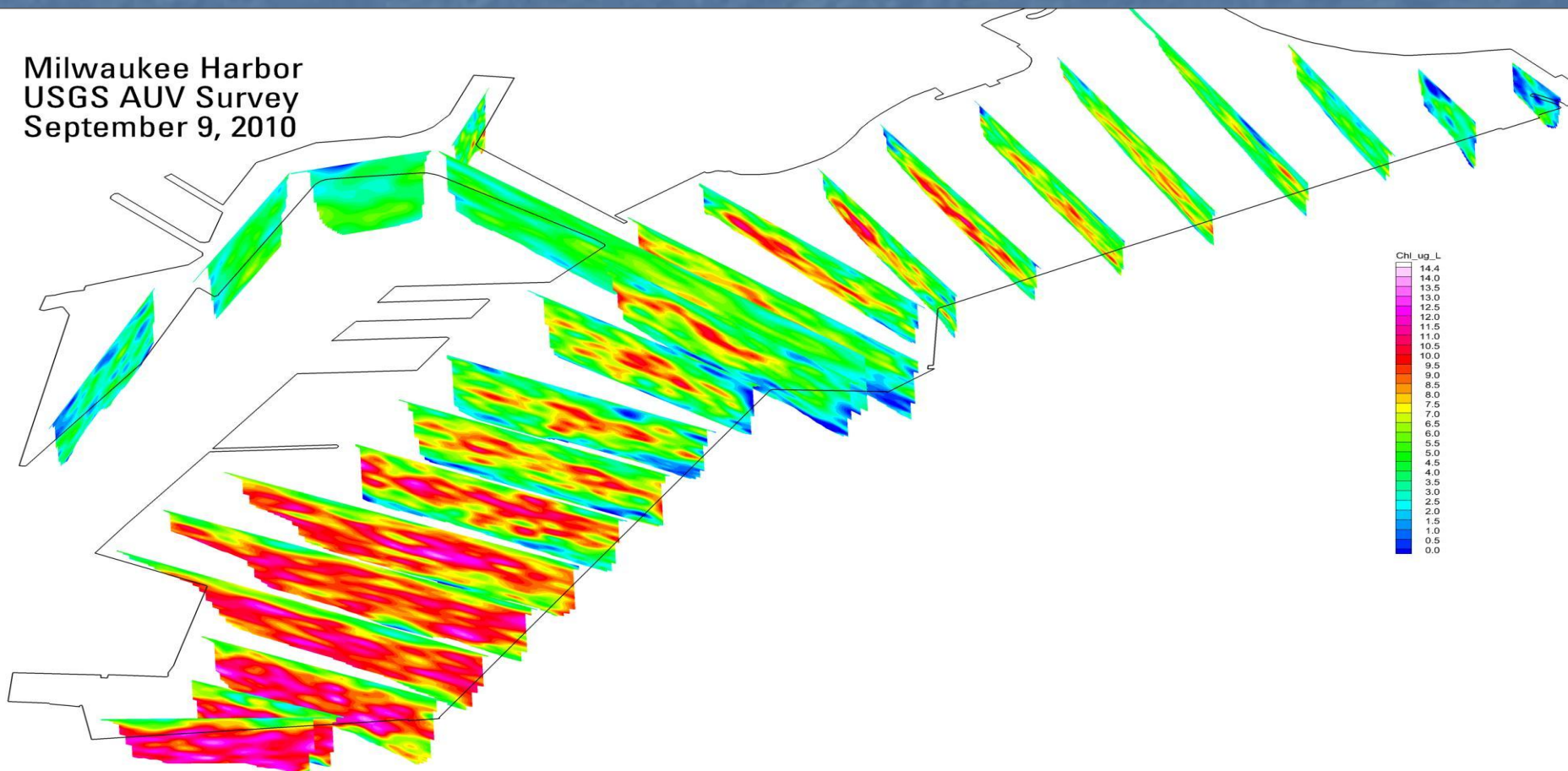
Testing Automated Underwater Vehicles and CDOM Sensors

- Test Ecomapper AUV) in Milwaukee Harbor (2010), Green Bay, Sheboygan and Muskegon (2011)
- Chromophoric Dissolved Organic Matter (CDOM) sensors tested at tributary gages and deployed from a boat in embayments as a surrogate for toxic contaminants
- Tie the river sensors and CDOM measurements to AUV work in the embayments, and Triaxus tow and buoy activities in the near shore, and to beach health monitoring.

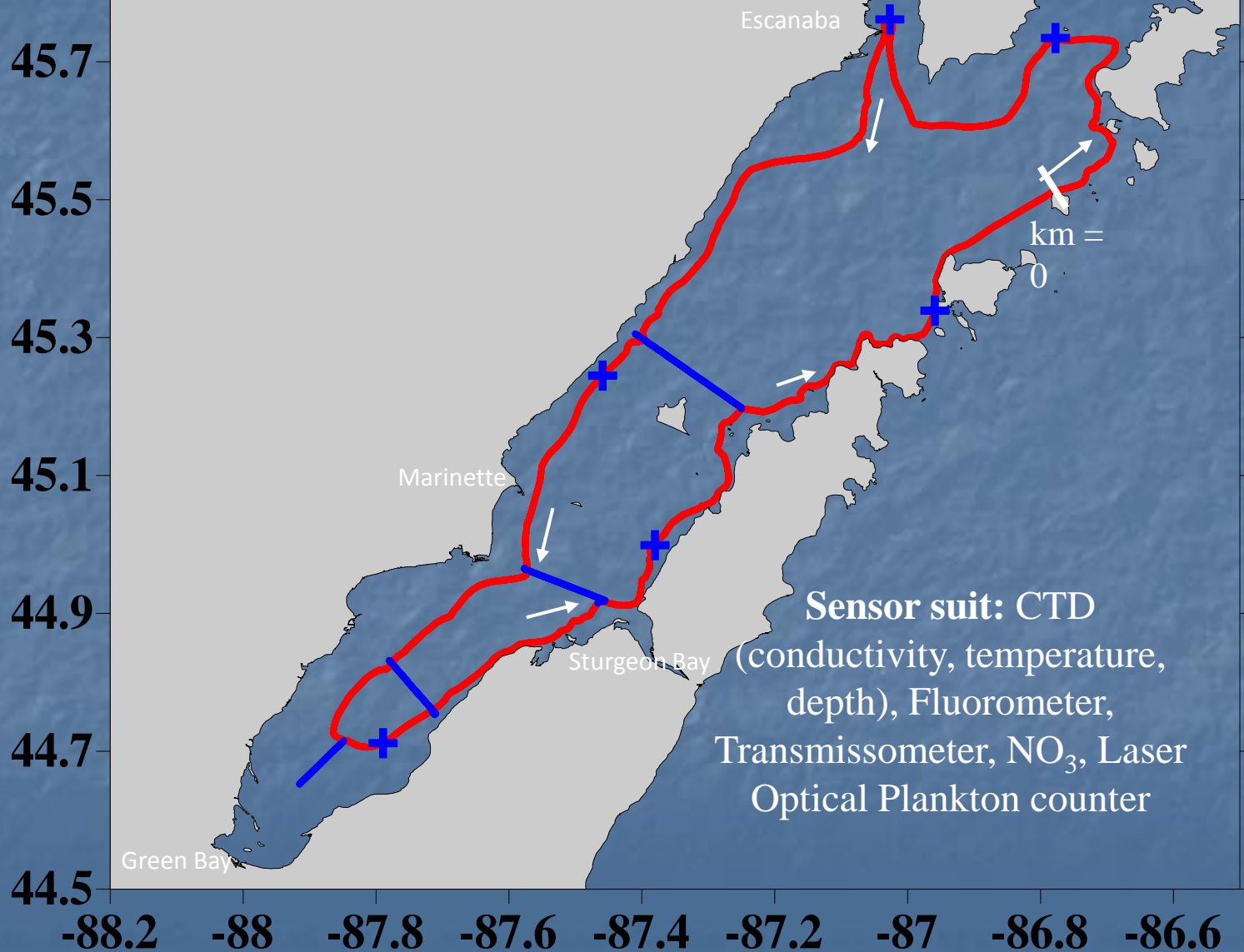


AUV Example Output - Chlorophyll

Milwaukee Harbor
USGS AUV Survey
September 9, 2010



Green Bay Lake Michigan August 23-25 2010



Thank you

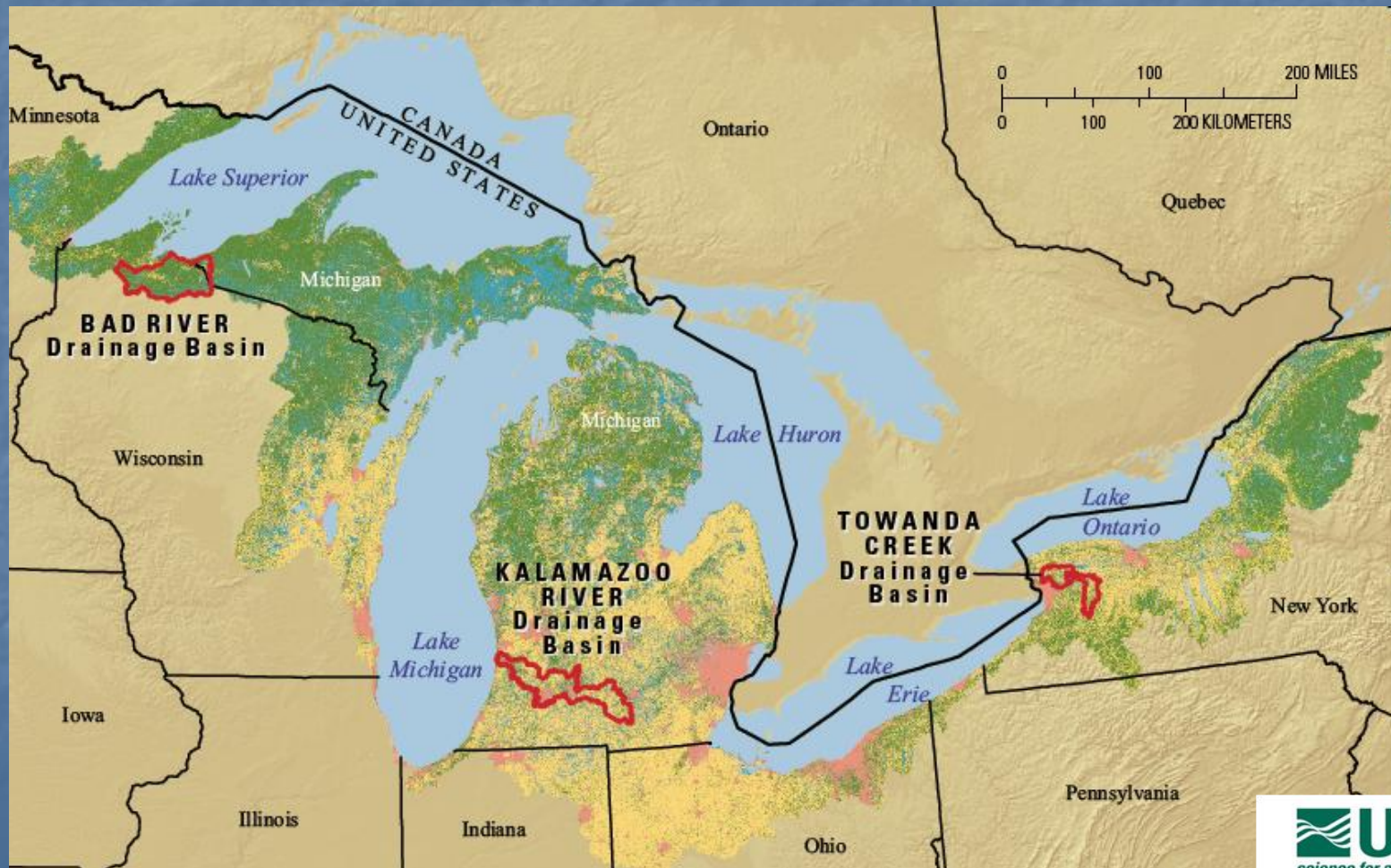


Questions?

Watershed modeling

- Identify current watershed modeling activities in the Great Lakes (in press)
- Develop HSPF models for 3 sub basins (**Kalamazoo, Towanda**, Bad), which are representative of the hydrogeology, physiography, land types, of a large region of the Great Lakes basin, and simulate water-quality processes
- Scenario development and comparison of results
 - Land–use changes
 - Management practices
 - Detention basins
 - Climate change

Land Cover Map of Three Watershed Modeling Basins



Hydro SPARROW

- Develop Hydro SPARROW – a GIS link between SPARROW (a water-quality model) and WATER/PRMS (water-quantity models)
- Use Hydro SPARROW to provide an estimate of phosphorus and nitrogen loading to the Great Lakes under a variety of land use and climate change scenarios